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**RESEARCH ORDER #1****PHASE IIa - PROGRESS REPORT #5**

This report covers the period from 1 April 1955 to 15 May 1955.

**OBJECTIVE:**

To conduct environmental tests on two units returned by customer, and to make modifications in the design of the equipment based on the results of the tests and on the customer's evaluation and experience in the field testing of all four design approval models.

To construct one unit, modified in accordance with the results of the environmental tests and customer evaluation of the equipment.

**DISCUSSION:**

Two of the four equipments were returned 18 April 1955.

The representative of the customer reported very satisfactory performance. It was originally expected to have an operating range of 6 miles. Customer reports indicated successful operation at ranges up to approximately 13 miles.

After inspection, evaluation, and the field tests, the customer requested certain modifications, mostly in the mechanical construction of the equipment, which will be discussed later in the report.

**PROCEDURE:**

The following environmental test procedures were established in a meeting between the contractor and customer personnel.

Vibration. This test will be conducted on one complete equipment as follows:

1. Maximum total excursion 0.060 inch.
2. Frequency range 5-55 cycles/second.
3. Twenty complete cycles of operation per plane; time of complete cycle - 1 minute and 30 seconds. Total operating time per plane - 30 minutes.

**CONFIDENTIAL**

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Non-Operating Temperature. This test will be conducted on one complete equipment as follows:

1. Temperature 160°F for a period of 4 hours.
2. Temperature -65°F for a period of 4 hours.

Thermal Shock. This test will be conducted to determine the effects of sudden change in temperature between two extremes. The extreme temperatures will be 90°F and -20°F, and the unit will be subjected to one shock from 90°F to -20°F, and to one shock from -20°F to 90°F.

Operating Temperature. This test will be conducted on two complete equipments as follows:

1. Temperature 130°F for a period of time necessary for temperature equilibrium in the unit.
2. Temperature -20°F for a period of time necessary for temperature equilibrium in the unit.

During the above periods of time the instruments will be operated to determine how satisfactory performance is under each condition. Also various component parts of the system such as the transmitter-receiver and power supply will be tested.

It is to be noted that a satisfactory operational test is rather difficult to carry out in the laboratory under the above extreme temperature conditions.

Humidity. This test will be a condensed version of a standard Signal Corps test. The test will be conducted for two cycling periods of 30 hours each. The units will be inspected and tested for operational performance at the end of the second cycling period.

Immersion. This test will be conducted on one final unit. The unit will be immersed in two feet of water for 2 hours. After removal from the water, the exterior will be dried by wiping. The unit will then be operated to determine performance.

Altitude. The unit will be placed under altitude test simulating plane transportation at 10,000 feet for a period of 30 minutes. Return to normal in a period of 5 minutes.

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Bench. The chassis and front panel assembly shall be removed from its enclosure, as for servicing, and placed in a suitable position for servicing on a solid 2-inch fir bench top. The test shall be performed as follows, in a manner simulating shocks likely to occur during servicing.

1. Tilt up the assembly through an angle of  $30^{\circ}$ , using one edge of the assembly as a pivot, and permit the assembly to drop back freely to the horizontal face.
2. Repeat step 1 until the unit has been dropped for a total of four drops onto each face upon which the assembly could be placed. Check optical alignment after completion of the test. Inspect unit for any damage.

Drop. This test will be conducted by dropping the unit from normal carrying height onto 2-inch fir boards backed by concrete. The unit will be dropped once on each end and once each on the bottom and top.

After field testing the equipment customer personnel suggested some changes in mechanical construction and a few additional features.

Following are some of the major changes requested in mechanical construction.

1. Provide an air bleeder for the bellows so that the bellows can be closed faster and easier.
2. Improve arrangement of snap fasteners to allow the covers to be fastened easier and more securely.
3. Eliminate fine elevation adjustment rod and mounts.
4. Eliminate the sweep-find mechanism.
5. Improve the tripod leg arrangement.
6. Arrange to have all auxiliary equipment, i. e. microphones and earphones as well as tripod legs and other auxiliary mechanical equipment that is packed for carrying or shipping, held securely in place by some simple mechanical means.
7. Redesign the yoke as follows:
  - a. Reduce all but the vertical pieces of the yoke to  $2/3$  of their present thickness. Use lightening holes for further reduction in weight.

CONFIDENTIAL

3.

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- b. Arrange spring detents on the side pieces of the yoke so that they will stand upright.
  - c. Arrange the slots in the side pieces of the yoke so that the studs and wing nuts on the equipment line up naturally when the equipment is held by the handle.
  - d. Eliminate one of the two wing nuts presently used.
  - e. Graduate the azimuth and elevation scale.
8. Provide covers for the windows in the front cover.
  9. Consider the possibility of adding a metallic sighting scheme to the present equipment.

In addition to the above things we are requested to do the following:

10. Add fittings to accommodate recording jacks.
11. Add jack to permit keying the 1000-cycle tone.
12. Modify electronic switching system to accommodate keying of 1000-cycle tone.
13. Improve the Night Viewer as follows:
  - a. Eliminate the lack of sharpness in the image.
  - b. Make the reticle more easily visible at night.
  - c. Eliminate as much parallax as possible.
  - d. Add a rubber boot (light shield) to the viewer eyepiece.

In addition to the above there were a number of minor changes, modifications, and additions requested.

#### RESULTS OF WORK FOR THE PERIOD:

Vibration tests have been concluded. In general the equipment stood up very well under the tests. However, trouble was encountered with the charger-regulator due to the fact that it was not properly supported. This problem has been solved by some minor redesign of the charger assembly itself, and by supporting the charger-regulator chassis rigidly to the bottom of the main frame.

Lead wires broke off of the vibrator frame located inside the vibrator can at their welds. The supplier was contacted. He furnished samples of vibrators with additional lead supports as well as rubber cushions to absorb energy to prevent whipping of the leads. Further, the samples had a smaller outside cover that limits the distance through which leads can move.

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Preliminary tests indicate that the new vibrators pass the vibration test.

In the non-operating test (-65°F) the epoxy resin viewer mold cracked. Tests are continuing.

Mechanical Design Changes. Practically all design changes which were required to accomplish the changes requested in mechanical construction have been completed. Any further changes can only be based on our findings in the remainder of the environmental tests.

Modifications, both mechanically and electrically, are presently being made to accommodate the keying circuit and the external recording system.

Improvements are being made on the Night Viewer. Means are being provided to illuminate the reticle and to eliminate parallax. A lightshield is being added to the viewer eyepiece.

PROGRAM FOR NEXT INTERVAL:

It is expected that environmental testing will be completed by 1 June 1955. The remaining tests are:

1. Operating Temperature
2. Thermal Shock
3. Humidity
4. Immersion
5. Altitude
6. Bench
7. Drop

Any further mechanical changes made after the above series of tests will be only such as can be completed in a matter of two or three days.

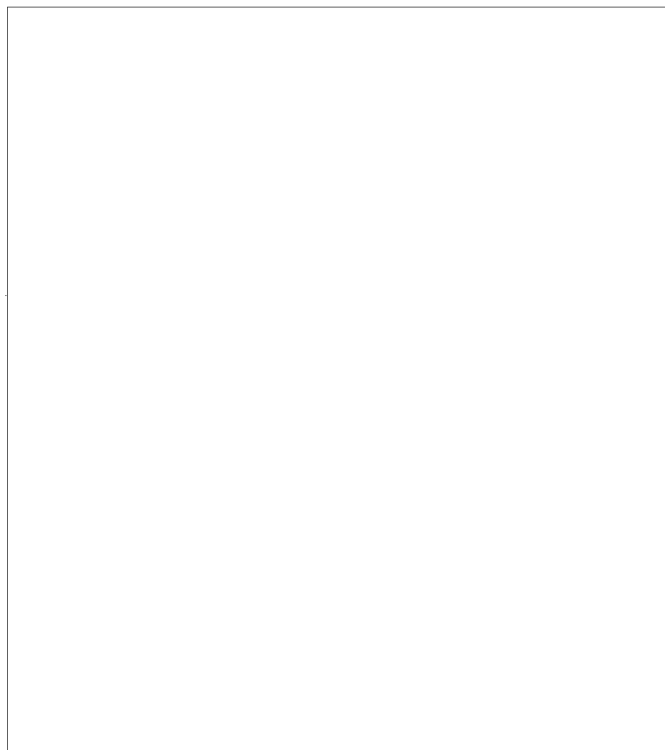
We therefore expect to complete the first of twenty (20) production units not later than 10 June 1955.

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**Report prepared by:**

**Report Approved by:**



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